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PENNIE & EDMONDS LLP DOCKET NO. 9677-004-999

Date: October 4, 2000

Express Mail No.: EL 451 595 123 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

10/03/00 U.S. PTO

Prior application: Examiner M. Bumgarner

Art Unit 3732

jc825 U.S. PTO 09/679135 10/03/00

Assistant Commissioner for Patents
Box PATENT APPLICATION
Washington, D.C. 20231

Sir:

This is a request for filing a ☒ continuation ☐ divisional application under 37 CFR § 1.53(b), of pending prior application no. 09/203,822 filed on December 1, 1998 in the name of:

Peter S. Wöhrle
(inventor(s) currently of record in prior application)

for Bioroot Endosseous Implant
(title of invention)

1. ☒ The filing fee is calculated below:

PATENT APPLICATION FEE VALUE

TYPE	NO. FILED	LESS	EXTRA	EXTRA RATE	FEE
Total Claims	1	-20	0	$18.00 each	$ 0.00
Independent	1	-3	0	$80.00 each	$ 0.00
				Basic Fee	$ 710.00
				Multiple Dependency Fee If Applicable ($260.00)	$ 0.00
				Total	$ 710.00
				50% Reduction for Independent Inventor, Nonprofit Organization or Small Business Concern	- $ 355.00
				Total Filing Fee	$ 355.00

2. ☒ Please charge the required fee to Pennie & Edmonds LLP Deposit Account No. 16-1150 (order no. 9677-004-999). A copy of this sheet is enclosed for such purpose.

3. ☒ Amend the specification by inserting before the first line the following sentence: This is a continuation of application no. 09/203,822, filed December 1, 1998.

4a. ☐ Transfer the drawings from the prior application to this application and abandon the prior application as of the filing date accorded this

application. A duplicate copy of this sheet is enclosed for filing in the prior application file.

4b. ☒ New formal drawings are enclosed.

4c. ☐ Informal drawings are enclosed.

5a. ☐ Priority of application no. filed on in is claimed under 35 U.S.C. §119.

5b. ☐ The certified copy has been filed in prior application no. , filed .

6. ☐ The prior application is assigned of record to .

7a. ☐ A copy of the Power of Attorney appears in the original papers.

7b. ☐ Since the Power of Attorney does not appear in the original papers, a copy of the Power for prior application no. is enclosed.

8. ☐ This application contains nucleic acid and/or amino acid sequences required to be disclosed in a Sequence Listing under 37 CFR §§1.821-1.825. It is requested that the Sequence Listing in computer readable form from prior application no., filed on be made a part of the present application as provided for by 37 C.F.R. §1.821(e). The sequences disclosed therein are the same as the sequences disclosed in this application. A copy of the paper Sequence Listing from application no. is enclosed.

9. ☐ The undersigned states, under 37 C.F.R. §1.821(f), that the content of the enclosed paper Sequence Listing from application no. is the same as the content of the computer readable form submitted in application no. .

10. ☒ Additional enclosures or instructions:

- a copy of the application and drawings as filed in the prior application is enclosed;
- a copy of the Declaration and Power of Attorney as filed in the prior application is enclosed;
- an Information Disclosure Statement and Citation Form without references for the previously filed application is enclosed;
- Please enter the Preliminary Amendment before calculating the filing fee.

Respectfully submitted,

Date October 3, 2000

45,645

Dion M. Bregman
for William S. Galliani
PENNIE & EDMONDS LLP
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(Reg. No.)
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: ☒ Application of: Peter S. Wöhrle
☐ Patent of:

☐ Serial No.:
☐ Patent No.:

Group Art Unit: To Be Assigned

☒ Filed: Herewith
☐ Issued:

Examiner: To Be Assigned

For: BIOROOT ENDOSSEOUS IMPLANT

Attorney Docket No.:
9677-003-999

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
[37 CFR 1.9(f) and 1.27(b)] - Independent Inventor

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(h) of Title 35, United States Code, to the Patent and Trademark Office with regard to the invention entitled BIOROOT ENDOSSEOUS IMPLANT described in

☒ the specification filed herewith
☐ application serial no. filed
☐ patent no. issued

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

☒ no such person, concern, or organization
☐ persons, concerns or organizations listed below*

*NOTE: Separate verified statements are required from each named person, concern, or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. [37 CFR 1.28 (b)]

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, and patent issuing thereon, or any patent to which this verified statement is directed.

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SIGNATURE OF INVENTOR Peter S. Wöhrle	SIGNATURE OF INVENTOR	SIGNATURE OF INVENTOR
DATE Nov. 20, 1998	DATE	DATE
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
SIGNATURE OF INVENTOR	SIGNATURE OF INVENTOR	SIGNATURE OF INVENTOR
DATE	DATE	DATE

Express Mail No. EL 451 595 123 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of: WÖHRLE	Art Unit: 3732
Serial No.: Continuation of 09/203,822	Examiner: Bumgarner, M
Filed: Herewith	Attorney Docket No. 9677-004-999
For: *Bioroot Endosseous Implant*	Date: October 3, 2000

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington D.C. 20231

Sir:

Please enter the following amendments into the file of the above identified application.

IN THE DRAWINGS:

Please amend figures 1 and 2 to remove reference numeral 5 and its associated lead line. In figure 5A, please delete reference numeral 36 and replace it with reference numeral 34. In figure 9, please delete the uppermost reference numeral 66 and its associated lead line. Please also exchange figure numbers 5A and 5B in figures 5A and 5B. Amendments are shown in red in the attached amended figures 1, 2, 5A, and 9. Furthermore, please substitute the attached amended formal drawings for the informal ones.

IN THE CLAIMS:

Please cancel claims 2-29.

If there are any fees or credits due in connection with the filing of this Amendment, including any fees required for an Extension of Time under 37 C.F.R. Section 1.136,

authorization is given to charge any necessary fees to our Deposit Account No. 16-1150 (order no. 9677-004-999). A copy of this sheet is enclosed for such purpose.

Respectfully submitted,

Date October 3, 2000

Reg. No. 45,645

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APPLICATION

IN

THE UNITED STATES
PATENT AND TRADEMARK OFFICE

for

BIOROOT ENDOSSEOUS IMPLANT

Inventor:

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BIOROOT ENDOSSEOUS IMPLANT

Peter S. Wöhrle

1. FIELD OF INVENTION

The present invention relates generally to the field of implant dentistry, and more particularly to the design of one- and two-stage endosseous implants.

2. BACKGROUND OF THE INVENTION

Endosseous, *i.e.*, intra boney, implants are commonly used to support fixed or removable prostheses where a patient's natural roots have been lost, and as a consequence, support is lacking to provide an adequate foundation onto which the dentist can rebuild a dentition. As the aging population retains more of their natural teeth, and as the younger generations want to take advantage of more conservative approaches offered by implant dentistry, *e.g.*, using a single implant rather than cutting down adjacent teeth to support a short span bridge to replace a missing tooth, implant dentistry has gained more and more popularity and has moved into the mainstream of dentists worldwide.

The current implant design is based on an endosseous fixture, a titanium screw that acts as an artificial root. Brånemark, *Tissue-Integrated Prostheses* (1985). Modifications made to the endosseous fixture have centered on the macro structure of the implant (*e.g.*, by exchanging the screw with a press-fit/cylindrical implant, a stepped screw or cylinder, or a tapered screw or cylinder), (Brunski J.B., *Biomechanics Of Oral Implant,. Future Research Directions* NIH Consensus Development Conference on Dental Implants, 1988; Kirsch A. *et al.*, *The IMZ Osseointegrated Implant System*, Dent. Clin. North Am. 1989 (4), 33:733-791; Niznick G.A., *A Multimodal Approach To Implant Prosthodontics*, Dent. Clin. North Am. 1989 (4), 33:869-878; Wennerberg A. *et al.*, *Design And Surface Characteristics Of 13 Commercially Available Oral Implant Systems*, *Id.* 1993:8:622-633; Siegele D. *et al.*, *Numerical Investigations Of The Influence Of Implant Shape On Stress Distribution In The Jaw Bone*, *Id.*, 1989:4:333-340; Olsson M. *et al.*, *MkII-a Modified Self-Tapping Brånemark Implant: 3-Year Results*, *Id.* at 1995:10:15-21; Langer B. *et al.*, *The Wide Fixture: A Solution For Special Bone Situations And A Rescue For The Compromised Implant, Part 1*, *Id.*, 1993:8:400-408; Schnitman P.A. *et al.*, *Implants For Partial Edentulism*, NIH

Consensus Development Conference On Dental Implants, 1988), on the micro structure (*e.g.*, surface modifications such as use of machined titanium, blasted titanium, titanium alloy, acid-etched titanium, plasma-sprayed titanium and hydroxyappatite coating such as growth factors and proteins), (Baier R.E. *et al.*, *Future Directions In Surface Preparation Of Dental Implants*, NIH Consensus Development Conference On Dental Implants, 1988; Young F.A., *Future Directions In Dental Implant Materials Research, Id.*; Krauser J., *Hydroxylappatite-Coated Dental Implants*, Dent. Clin. North Am. 1989, 33:4:879-903; Buser D. *et al.*, *Tissue Integration Of One-Stage ITI Implants: 3-Year Results Of A Longitudinal Study With Hollow-Cylinder And Hollow-Screw Implants*, Int. J. Oral Maxillofac. Implants, 1991:6:405-412), on one-vs-two-stage designs, (Weber H.P. *et al.*, *Comparison Of Healed Tissues Adjacent To Submerged And Non-Submerged Unloaded Titanium Dental Implants*, Clin. Oral Impl. Res. 1996:7:11-19; Busser D. *et al.*, *Tissue Integration Of One-Stage ITI Implants: 3-Year Results Of A Longitudinal Study With Hollow-Cylinder and Hollow-Screw Implants*, Int. J. Oral Maxillofac Implants 1991:6:405-412), and on modifying the connection between the implant and its abutment (*e.g.*, either internal hex, external hex, standard hex, tall hex, wide hex, etc.), (U.S. Pat. No. 4,960,381; U.S. Pat. No. 5,407,359; U.S. Pat. No. 5,209,666; U.S. Pat. No. 5,110,292).

Irrespective of the design variables discussed above, current systems have two general characteristics in common: First, the abutment-implant interface is planar; and second, the area intended for bone apposition, *i.e.*, osseointegration, terminates parallel to the abutment-implant interface, 360 degrees around the implant.

Traditionally, endosseous implants were designed for treatment of the fully edentulous patient. In general, this particular patient population exhibits reduced bone-tissue volume, both in height and width when compared to the partially edentulous patient with recent or impending tooth loss. However, the bone-tissue morphology of partially edentulous patients significantly differs from that of fully edentulous patients, in that the naturally occurring supporting bone structures reveal a scalloped architecture around the tooth.

Currently available implant technology does not take the different bone-tissue morphologies into consideration. Heretofore use of an implant with an intended bone-tissue apposition surface parallel to a flat abutment-implant interface has led to either (1) placement of soft-tissue intended parts of the implant within bone-tissue, leading to bone-tissue resorption in these areas, and/or (2) exposure of hard-tissue intended surfaces to the soft tissue, resulting in possible peri-implant infections due to bacterial colonization around the rough surface and potential loss of the implant.

3. SUMMARY OF THE INVENTION

The present invention is directed towards novel endosseous implants, which are structured to better maintain hard and soft-tissue in the area where the implant exits from the bone-tissue and transverses the soft-tissue. More particularly, the implants of the present invention are designed so that areas intended for hard- and soft-tissue apposition exhibit a scalloped appearance, including convex and/or concave patterns, which approximate the naturally occurring bone morphology. Thus, the implants of the present invention provide substantially increased attachment possibilities for both bone-tissue and soft-tissue, thereby facilitating bone-tissue and soft-tissue preservation and maintenance.

The present invention will enable the surgeon to place an implant into residual bone with the surface of the implant intended for bone-tissue contact and apposition (machined or roughened, surface coated or textured, altered with biologic modifiers such as proteins and growth factors, or any combination thereof) being substantially in contact with bone-tissue, and with the surface intended for soft-tissue apposition (polished/treated with soft tissue specific surface modifications) being substantially in contact with soft-tissue.

More specifically, the implant, according to an embodiment of the present invention, is a substantially cylindrical shaft made from a biocompatible material having a distal end and a proximal end. A bone-tissue/soft-tissue transition region and a abutment-implant interface are both disposed towards the proximal end of the shaft. The bone-tissue/soft-tissue transition region is defined as the approximate region of the shaft and/or the abutment-implant interface where the implant exits the bone-tissue and transverses into the soft-tissue. The bone-tissue/soft-tissue transition region has a bone-tissue apposition surface configured to approximate the physiological contours of the alveolar bone. In a two-stage implant, the abutment-implant interface may be either substantially planar, approximately 90^0 to the longitudinal axis of the shaft, or contoured to approximate the contour of the alveolar bone. In a one-stage implant the abutment is permanently attached to the abutment-implant interface, or an integral part of the implant itself. The abutment, in both one-and two-stage implants, has an abutment-crown interface, which is either substantially planar or contoured to approximate the contour of the alveolar bone, and a chimney onto which the crown is secured.

An implant constructed according to the principles of the present invention facilitates hard- and soft-tissue maintenance, increases longevity of the implant and improves its aesthetic appearance. As will be readily apparent to the skilled artisan, the present invention may be applied to numerous prosthetic applications, such as, but not limited to, a single tooth replacement, an abutment for a bridge (fixed partial denture)

regardless of the nature of the other abutment (natural tooth or implant), a pier abutment or an over denture abutment.

4. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts a frontal view of a prior art implant;

FIG. 2 depicts an interproximal view of the prior art implant in FIG. 1;

FIG. 3 depicts a frontal view an implant according to an embodiment of the present invention;

FIG. 4 depicts an interproximal view of the implant in FIG. 3;

FIG. 5A depicts a three-dimensional top frontal view of the implant in FIG. 3;

FIG. 5B depicts a three-dimensional interproximal top view of the implant in FIG. 3

FIG. 6 depicts a frontal view of an implant according to another embodiment of the present invention;

FIG. 7 depicts an interproximal view of the implant in FIG. 6;

FIG. 8 depicts a three-dimensional top view of the implant in FIG. 6;

FIG. 9 shows a frontal view of an implant according to another embodiment of the present invention;

FIG. 10 depicts an interproximal view of the implant in FIG. 9;

FIG. 11 depicts a frontal view of an implant according to another embodiment of the present invention; and

FIG. 12 depicts an interproximal view of the implant in FIG. 11.

5. DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 and 2 show prior art implant 10, abutment-implant interface 12, abutment 14 and crown 16 constructed according to the current state of the art. Implant 10, according to the current state of the art, has a bone apposition surface 17, typically threads or otherwise roughened surface, extending into alveolar bone 18. Abutment-implant interface 12 extends partially into the alveolar bone and has polished surface 20, which is not suitable for bone apposition. Use of implant 10, constructed according to the current state of the art, results in bone-tissue resorption in bone-tissue/soft-tissue transition region 22 because polished surface 20 contacts bone-tissue, which as discussed, leads to bone resorption. Any loss of natural bone structure or topography is highly undesirable from both structural and aesthetic perspectives. Even the smallest bone-tissue loss between the tooth and an implant will lead to soft-tissue shrinkage due to lack of boney support, resulting in "black triangles" (open spaces) between the teeth–a highly unaesthetic situation.

FIGS. 3 and 4 show a two-stage implant according to an embodiment of the present invention. Implant 24 has shaft 26, substantially planar abutment-implant interface 28, distal end 30, proximal end 32 and bone-tissue/soft-tissue transition region 34. Abutment 36 and crown 38 are attached to implant 24 using means well known to the skilled artisan for two-stage implants. Implant 24 is made from a biocompatible material, including but not limited to, metal, ceramic, glasses or any combination thereof. Preferably implant 24 is made from titanium or an alloy thereof.

Bone-tissue/soft-tissue transition region 34 has a scalloped bone-tissue apposition surface 42, which approximately follows the naturally occurring contours of existing bone 40, and a scalloped soft-tissue apposition surface 44, which approximately follows the naturally occurring contours of the existing soft-tissue (not shown). Thus, there are two distinctive scalloped tissue-attachment surfaces: bone-tissue apposition surface 42 to maintain the naturally occurring bone-tissue morphology; and soft-tissue apposition surface 44 to maintain the naturally occurring soft-tissue morphology. The degree of scalloping or the height of the convex and concave regions depends on, *inter alia*, the degree of existing bone-tissue resorption, the size of the implant, the implant location within the arch, the bone morphology and the soft-tissue morphology. The dimensions are similar to the scalloped appearance of the cemento-enamel (CE) junction observed on natural teeth. The vertical difference between the highest and lowest point of the scalloped margin ranges from less than 1mm on posterior teeth to approximately 3-5mm on anterior teeth. By way of example, bone-tissue apposition surface 42 can be obtained by machining, application of textured surfaces, acid etching, blasting with particles, applying growth factor, applying protein, or other materials that promote, enhance, and/or maintain bone-tissue growth and/or apposition. Also by way of example, soft-tissue apposition surface 44 can be achieved by polishing or other treatment that leaves a surface to promote, enhance, and/or maintain soft-tissue growth and/or apposition. Below the bone-tissue/soft-tissue transition region 34, shaft 26 has threads 45, or other means well known in the art, to anchor the implant into the alveolar bone.

In use, the surgeon inserts distal end 30 into the alveolar bone such that bone-tissue apposition surface 42 and soft-tissue apposition surface 44 approximately mirror the existing bone- and soft-tissue morphology respectively. The implant should be aligned such that the highest points of bone apposition surface 42 are substantially aligned with the interproximal areas of the bone-tissue and such that the lowest points are substantially aligned with the buccal and lingual area of the bone-tissue. In a two-stage process, the surgeon sutures tissue over the implant, waits several months for the bone to adhere to the

implant, opens the tissue, attaches abutment 36 to abutment-implant interface 28 and attaches crown 38 to abutment 36. Bone-tissue apposition surface 42 and soft-tissue apposition surface 44 maintain bone- and soft-tissue attachment levels and facilitate prevention of peri-implant infections, which occur due to increased peri-implant pocket depths frequently observed with the prior art implant designs. Therefore, implants constructed according to the present invention increase the longevity of the implant and improve the aesthetic appearance of the restoration.

Referring to FIGS. 5A and 5B, abutment-implant interface 28 has substantially planar upper surface 25, which is approximately 90^0 to the longitudinal axis of shaft 26, and connecting means 46 for connecting abutment 36 (FIGS. 3 and 4) to abutment-implant interface 28. Connecting means 46 is well known in the art and includes, but is not limited to, internal hex, external hex, standard hex, tall hex, wide hex or camlog. In an alternative embodiment of the present invention, as shown in FIGS. 6-8, abutment-implant interface 48 has at least its edges contoured to approximate the contours of the alveolar bone, thereby defining a contoured upper surface 50 (FIG. 8) surrounding connecting means 46. Also provided in this alternative embodiment is abutment 52, which has lower contoured surface 54 configured to substantially mate with contoured upper surface 50. The upper and lower contoured surfaces provide additional lateral support between abutment 52 and abutment-implant interface 48. Additionally, contoured upper surface 48 of this alternative embodiment results in a narrower depth between gum line 54 and abutment-implant interface 48 (FIGS. 6 and 7), thus enhancing longevity of the restoration as a result of decreased pocket depths.

A skilled artisan will readily recognize that the principles of the present invention can be equally applied to one-stage as well as two-stage processes. For example, FIGS. 9 and 10 show one-stage implant 58, according to another embodiment of the present invention. Implant 58 includes shaft 60, distal end 62, proximal end 64 and bone-tissue/soft-tissue transition region 66 with scalloped bone-tissue apposition surface 42 and scalloped soft-tissue apposition surface 44, as substantially described above. Abutment 69 is permanently attached to the one-stage implant 58 as is well know in the art.

One-or two-stage implants, according to alternative embodiments of the present invention, may include either a planar abutment-crown interface 68 (FIGS. 3, 4, 9 and 10) or a contoured abutment-crown interface 70 (FIGS. 6, 7, 11 and 12), the latter of which substantially matches the natural contour of the alveolar bone. Contoured abutment-crown interface 70 allows for crown 38, in both one-and two-stage implants, to extend further towards the gum line, thereby resulting in a more aesthetically pleasing restoration.

Chimney 72, or other means well known to the skilled artisan, is provided in both one-and two-stage implants according to the present invention for attaching crown 38 to the abutment.

Although various embodiments of the present invention have been described, the descriptions are intended to be merely illustrative. Thus, it will be apparent to the skilled artisan that modifications may be made to the embodiments as described herein without departing from the scope of the claims set forth below.

CLAIMS

What Is Claimed Is:

1. An endosseous dental implant, comprising:

a shaft made from a biocompatible material, said shaft having a distal end and a proximal end;

an abutment-implant interface disposed towards the proximal end of said shaft; and

a bone-tissue apposition surface configured to approximate the physiological contours of naturally occurring bone-tissue morphology.

2. The endosseous dental implant according to Claim 1, wherein said bone-tissue apposition surface has a scalloped appearance.

3. The endosseous dental implant according to Claim 2, wherein the highest points of said bone-tissue apposition surface substantially aligns with the interproximal areas of the bone-tissue, and wherein the lowest points of said bone-tissue apposition surface substantially aligns with the buccal and lingual area of the bone-tissue.

4. The endosseous dental implant according to Claim 1 further comprising:

a soft-tissue apposition surface configured to approximate the physiological contours of naturally occurring soft-tissue morphology.

5. The endosseous dental implant according to Claim 1 further comprising:

a means for connecting an abutment to said abutment-implant interface for use in a two-stage procedure.

6. The endosseous dental implant according to Claim 5, wherein said abutment-implant interface has a substantially planar upper surface approximately 90^0 to the longitudinal axis of said shaft, and wherein said planar upper surface substantially surrounds said means for connecting.

7. The endosseous dental implant according to Claim 5, wherein said abutment-implant interface has a contoured upper surface, and wherein said contoured upper surface substantially surrounds said means for connecting.

8. The endosseous dental implant according to Claim 7, wherein a lower surface of the abutment substantially abuts against said contoured upper surface, thereby providing improved lateral support.

9. The endosseous dental implant according to Claim 1, further comprising:

an abutment permanently attached to said abutment-implant interface for use in a one-stage procedure.

10. The endosseous dental implant according to Claim 9, wherein said shaft and said abutment are constructed from a single piece of material.

11. The endosseous dental implant according to Claim 9, wherein said abutment has a substantially planar upper surface approximately 90^0 to the longitudinal axis of said shaft and wherein said planar upper surface substantially surrounds a chimney.

12. The endosseous dental implant according to Claim 9, wherein said abutment has a contoured upper surface and wherein said contoured upper surface substantially surrounds a chimney.

13. A two-stage endosseous dental implant, comprising:

a shaft made from a biocompatible material, said shaft having a distal end and a proximal end;

an abutment-implant interface disposed towards the proximal end of said shaft;

a bone-tissue apposition surface configured to approximate the physiological contours of naturally occurring bone-tissue morphology; and

a means for connecting an abutment to said abutment-implant interface.

14. The two-stage endosseous dental implant according to Claim 13, wherein said abutment-implant interface has a substantially planar upper surface approximately 90^0 to the longitudinal axis of said shaft, and wherein said planar upper surface substantially surrounds said means for connecting.

15. The two-stage endosseous dental implant according to Claim 13, wherein said abutment-implant interface has a contoured upper surface and wherein said contoured upper surface substantially surrounds said means for connecting.

16. A one-stage endosseous dental implant, comprising:

a shaft made from a biocompatible material, said shaft having a distal end and a proximal end;

a bone-tissue apposition surface configured to approximate the physiological contours of naturally occurring bone-tissue morphology; and

an abutment permanently attached to the proximal end of said shaft.

17. The one-stage endosseous dental implant according to Claim 16, wherein said abutment has a substantially planar upper surface approximately 90^0 to the longitudinal axis of said shaft, and wherein said planar upper surface substantially surrounds a chimney.

18. The one-stage endosseous dental implant according to Claim 16,wherein said abutment has a contoured upper surface and wherein said contoured upper surface substantially surrounds a chimney.

19. A two-stage endosseous dental implant system, comprising:

a shaft made from a biocompatible material, said shaft having a distal end and a proximal end;

a bone-tissue apposition surface configured to approximate the physiological contours of naturally occurring bone-tissue morphology;

an abutment-implant interface disposed towards the proximal end of said shaft;

an abutment configured to attach to said abutment-implant interface;

a means for connecting said abutment to said abutment-implant interface; and

a crown having a distal end configured to fit over said abutment.

20. The two-stage endosseous dental implant system according to Claim 19, wherein said abutment-implant interface has a substantially planar upper surface substantially surrounding said means for connecting, and wherein said upper planar surface is approximately 90^0 to the longitudinal axis of said shaft.

21. The two-stage endosseous dental implant system according to Claim 20, wherein said abutment has a substantially planar upper abutment-crown interface surface.

22. The two-stage endosseous dental implant system according to Claim 20, wherein said abutment has a contoured upper abutment-crown interface surface substantially surrounding a chimney, and wherein the distal end of said crown is configured such that at least the outside surface of said crown extends to and follows the contours of upper abutment-crown interface and/or the contours of said abutment-implant interface, thereby providing a narrow depth between the distal end of said crown and naturally occurring bone-tissue morphology..

23. The two-stage endosseous dental implant system according to Claim 20, wherein said abutment-implant interface has a contoured upper surface substantially surrounding said means for connecting, and said contoured upper surface approximately matches the contour of the natural bone morphology, and wherein said abutment has a lower surface configured to substantially abut said contoured upper surface.

24. The two-stage endosseous dental implant system according to Claim 23, wherein said abutment has a substantially planar upper abutment-crown interface surface.

25. The two-stage endosseous dental implant system according to Claim 23, wherein said abutment has a contoured upper abutment-crown interface surface substantially surrounding a chimney, and wherein the distal end of said crown is configured such that at least the outside surface of said crown extends to and follows the contours of upper abutment-crown interface and/or the contours of said abutment-implant interface, thereby providing a narrow depth between the distal end of said crown and naturally occurring bone-tissue morphology.

26. A one-stage endosseous dental implant system, comprising:

a shaft made from a biocompatible material, said shaft having a distal end and a proximal end;

a bone-tissue apposition surface configured to approximate the physiological contours of naturally occurring bone-tissue morphology;

an abutment securely attached to the proximal end of said shaft; and

a crown having a distal end configured to secure to said abutment.

27. The one-stage endosseous dental implant system according to Claim 26, wherein said abutment has a substantially planar upper surface substantially surrounding a chimney, and wherein said upper planar surface is approximately 90^0 to the longitudinal axis of said shaft.

28. The one-stage endosseous dental implant system according to Claim 26, wherein said abutment has a contoured upper surface substantially surrounding a chimney, and wherein said contoured upper surface approximately matches the contour of naturally occurring bone-tissue morphology.

29. The one-stage endosseous dental implant system according to Claim 28, wherein the distal end of said crown is configured such that at least the outside surface of said crown extends to and follows the contours of said contoured upper surface, thereby providing a narrow depth between the distal end of said crown and the naturally occurring bone level.

ABSTRACT

The present invention relates to novel endosseous implants, which are designed so that the areas intended for bone apposition exhibit a scalloped appearance, including both convex and concave patterns, to follow the naturally occurring bone morphology. Thus, the disclosed implants provide attachment possibilities for both bone and soft tissue, thereby effecting both hard- and soft-tissue preservation.

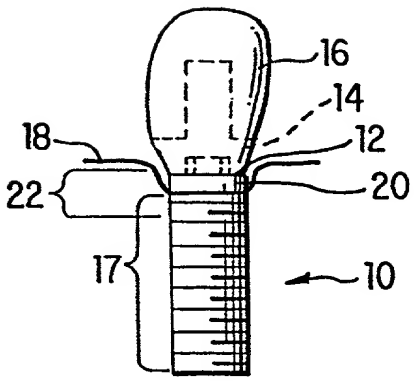

FIG. 1 (PRIOR ART)

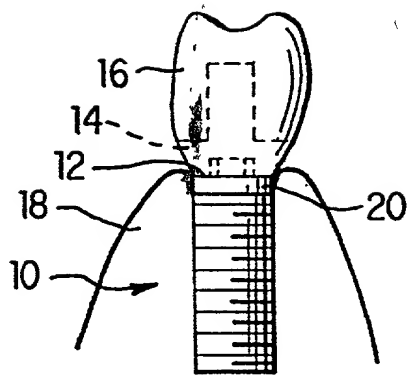

FIG. 2 (PRIOR ART)

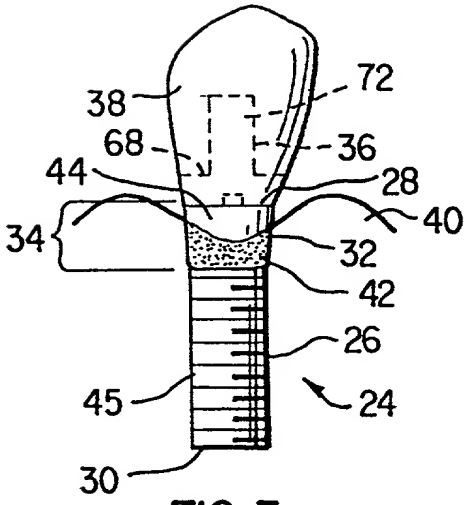

FIG. 3

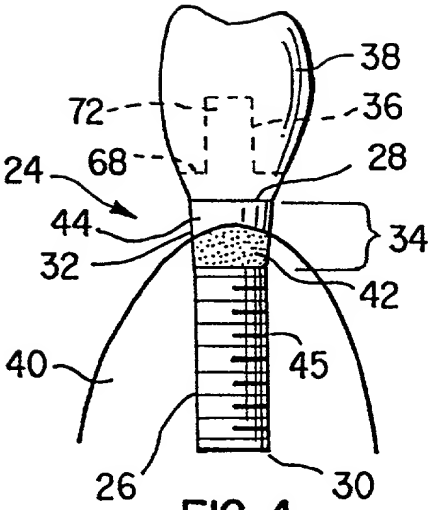

FIG. 4

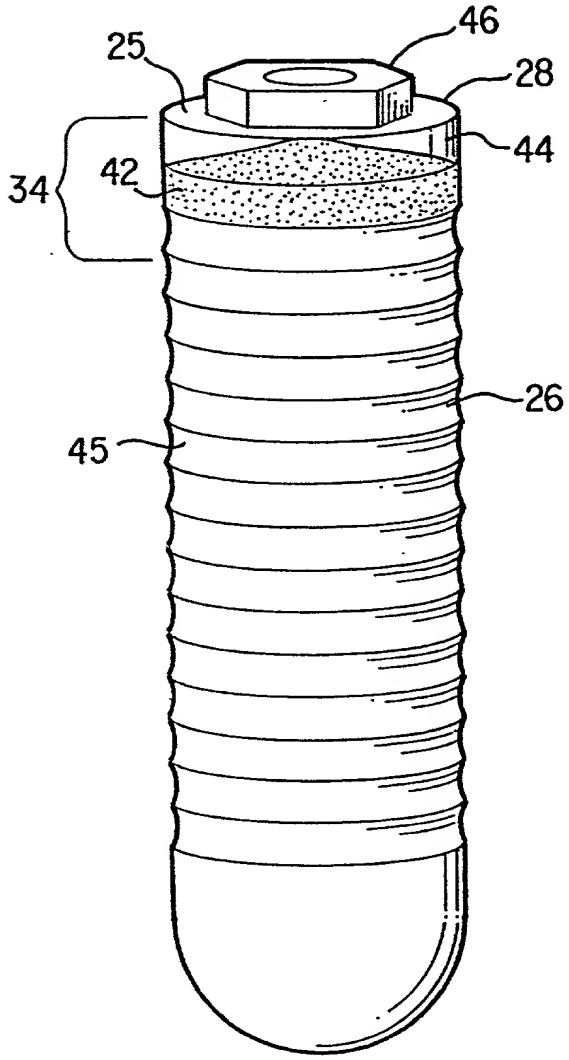

FIG. 5B

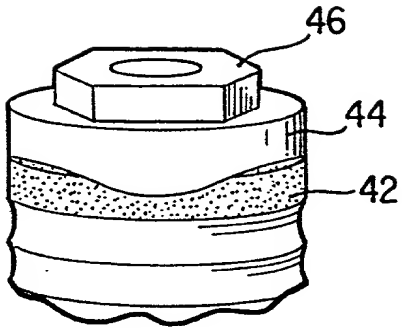

FIG. 5A

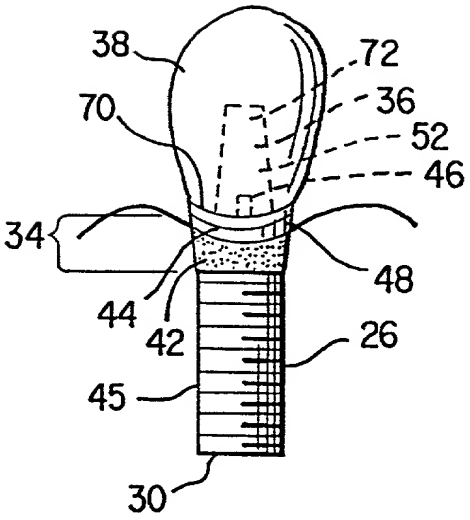

FIG. 6

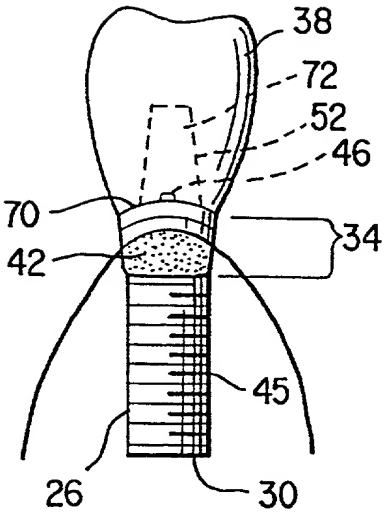

FIG. 7

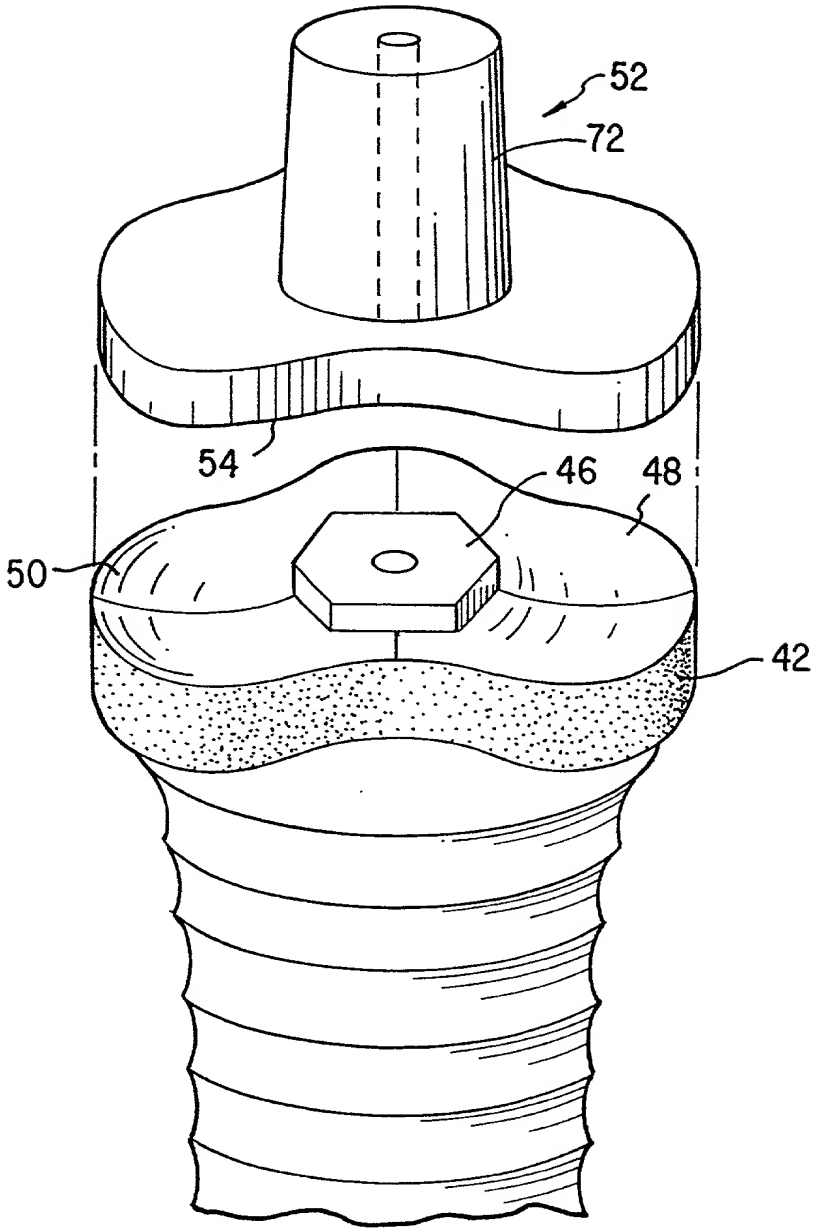

FIG.8

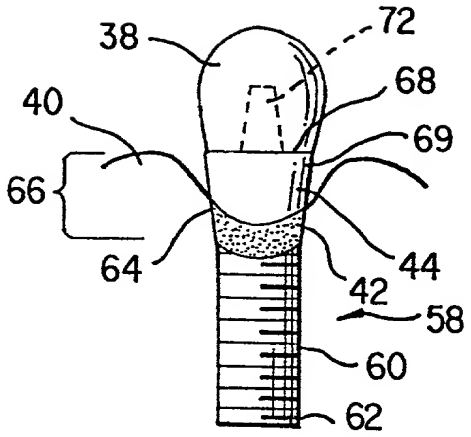

FIG. 9

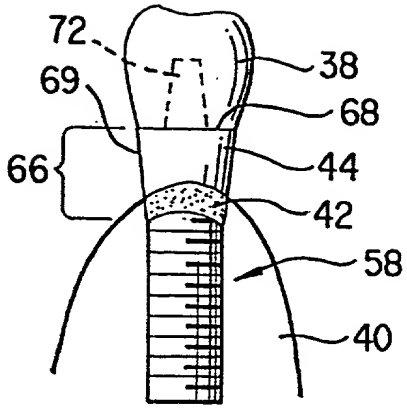

FIG. 10

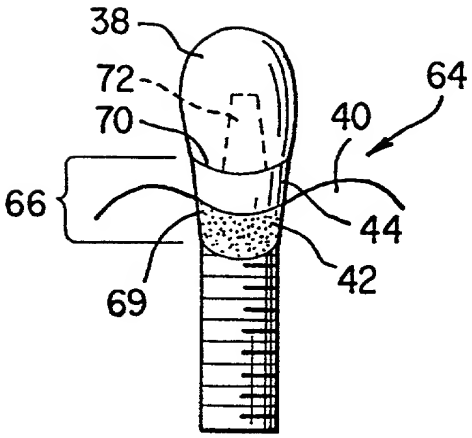

FIG. 11

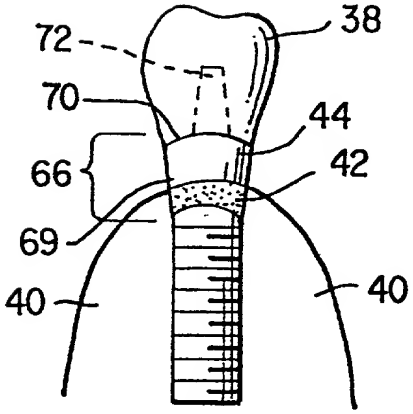

FIG. 12

DECLARATION
AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below at 201 et seq. underneath my name.

I believe I am the original, first and sole inventor if only one name is listed at 201 below, or an original, first and joint inventor if plural names are listed at 201 et seq. below, of the subject matter which is claimed and for which a patent is sought on the invention entitled

BIOROOT ENDOSSEOUS IMPLANT

and for which a patent application:
☒ is attached hereto and includes amendment(s) filed on *(if applicable)*
☐ was filed in the United States on as Application No. *(for declaration not accompanying application)*
with amendment(s) filed on *(if applicable)*
☐ was filed as PCT international Application No. on and was amended under PCT Article 19 on *(if applicable)*

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

EARLIEST FOREIGN APPLICATION(S), IF ANY, FILED PRIOR TO THE FILING DATE OF THE APPLICATION			
APPLICATION NUMBER	COUNTRY	DATE OF FILING (day, month, year)	PRIORITY CLAIMED
			YES ☐ NO ☐
			YES ☐ NO ☐

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below.

APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NO.	FILING DATE	STATUS		
		PATENTED	PENDING	ABANDONED

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	POST OFFICE ADDRESS	STREET	CITY	STATE OR COUNTRY	ZIP CODE
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	POST OFFICE ADDRESS	STREET	CITY	STATE OR COUNTRY	ZIP CODE
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	POST OFFICE ADDRESS	STREET	CITY	STATE OR COUNTRY	ZIP CODE
205	FULL NAME OF INVENTOR	LAST NAME	FIRST NAME	MIDDLE NAME	
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP	
	POST OFFICE ADDRESS	STREET	CITY	STATE OR COUNTRY	ZIP CODE
206	FULL NAME OF INVENTOR	LAST NAME	FIRST NAME	MIDDLE NAME	
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP	
	POST OFFICE ADDRESS	STREET	CITY	STATE OR COUNTRY	ZIP CODE

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201 - Peter S. Wöhrle	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE NOV. 20, 1998	DATE	DATE
SIGNATURE OF INVENTOR 204	SIGNATURE OF INVENTOR 205	SIGNATURE OF INVENTOR 206
DATE	DATE	DATE